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(54) **MICROCHANNEL GEL ELECTROPHORETIC SEPARATION SYSTEMS AND METHODS FOR PREPARING AND USING**

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(52) **U.S. Cl.**

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(58) **Field of Classification Search**

USPC 422/82.05, 82.07; 600/312, 321, 329; 204/450–452

See application file for complete search history.

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(57) **ABSTRACT**

A micro-analytical platform for performing electrophoresis-based immunoassays was developed by integrating photopolymerized cross-linked polyacrylamide gels within a microfluidic device. The microfluidic immunoassays are performed by gel electrophoretic separation and quantifying analyte concentration based upon conventional polyacrylamide gel electrophoresis (PAGE). To retain biological activity of proteins and maintain intact immune complexes, native PAGE conditions were employed. Both direct (non-competitive) and competitive immunoassay formats are demonstrated in microchips for detecting toxins and biomarkers (cytokines, c-reactive protein) in bodily fluids (serum, saliva, oral fluids). Further, a description of gradient gels fabrication is included, in an effort to describe methods we have developed for further optimization of on-chip PAGE immunoassays. The described chip-based PAGE immunoassay method enables immunoassays that are fast (minutes) and require very small amounts of sample (less than a few microliters). Use of microfabricated chips as a platform enables integration, parallel assays, automation and development of portable devices.

5 Claims, 15 Drawing Sheets